The 50 MHz DX Bulletin

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The 50 MHz DX Bulletin was founded by Harry Schools KA3B. It is dedicated to the understanding and utilization of long distance propagation in the 6-meter Amateur band. This issue, edited and published by Victor Frank, K6FV, is the third of a half-dozen "fill-in" issues and was actually written in July 1993. Circulation matters and DX reports should be sent to Victor Frank, K6FV, 12450 Skyline Blvd., Woodside, CA 94062-4541 USA. The Bulletin may be freely quoted, provided that credit is given.

In my opinion .....

by 9H5EE John Dougal

There has always been talk (as well as some heated arguments) on what DX means, use of 50.110, and other related matter. I would now like to express a few points of my own view based on my experience.

Everybody has a right to the use of the calling frequency. This goes for both calling and listening. I, for one, would like to leave my rig tuned on 50.110 while attending to other things in my house. I do not really like the idea to set my rig to scan the whole band or large parts of it. Not all the rigs are able to do that either. Still, I would like to know when the band is open. I would like to hear someone calling CQ every now and then. This should ideally be followed by a generously long listening period as well as giving others their fair share of the calling frequency. Then, if there is a reply, one should move to some other frequency, but please not just 3 kHz up or down. I would also like to hear, during an opening, individuals calling a brief CQ while specifying their working frequency. Something which I never hear during an opening, but would very much like to if and when the calling frequency is clear, is a brief announcement of who is where when something new or exciting is on the band. This should be an attractive incentive to keep the calling frequency clear during the actual openings!

A habit of a few which I find most annoying is that when someone sits for hours sending out endlessly repetitive 40 second CQ calls from a CW keyer, with hardly 20 second intervals, on any particular frequency which has just been as the QRG for any particular DX activity. I see this action as selfish QRM which disturbs me as much as anybody's nattering on the calling frequency.

'DX' frequently seems to be wrongly (in my opinion) associated with long distance. I believe that DX stands for Data eXchange. That means that when you establish a QSO, you exchange only the report and other brief relevant and useful data. Strictly speaking, this could also just be the one down the road who has just switched on for the first time and bumped onto you! Please, shall we all be more considerate.

Conditions in South Korea

by Louis Anciaux, HL9UH

The telephone extenders are prolific! I had problems with them in Manila also. One was a block away running a 100 W amplifier and in-band on 50.260! They seem to be coming from both Taiwan and Hong Kong, and anyone can buy the damn things. Whenever BV is in, the band is cluttered w/ the telephone extenders. I have never heard the VS6 beacon; but did make one WEAK QSO with VS6BG earlier in May. 9M6 isn't bad, P29 was a good path in evenings during Fall and Spring. I used to have long (2+ hr) QSOs with P29CW most evenings. I did get one of the XUs, but he was also weak! The other was heard fading out on the same day. The couple of DX-peditions to SE Asia have not netted anything here either. Further east has been dismal, as you will note. At least when I get the EME system going, I may be able to do some DXing there!

I just got in the hardware from M^2, so I will be able to start in earnest with the tower and project. I have to go to SDGO June 18 for ten days, so won't make it on until at least July. All the construction around the house has kept me away from getting the systems up. The work should be done by the time I return, so I can at least have free access to the yard, house, and power! It really has been a pain with all this torn-up yard, etc. The kitchen goes in two weeks for about the same period. That, and the yard work should all be done by the end of the month.

The QTH, besides being surrounded by high hills, is a pleasant change from Manila. I do have some QRN (nothing like Manila though!), but the air is clean and breathable; the water is drinkable from the tap; the power doesn't go off for 6-8 hours every day (even worse there now!); and I don't have to drive in an armored car everywhere. I expect to be here until July '94, then most likely will retire from the Navy and head for HP3.

I am working on various projects for the new home QTH near David (Panama), and may make another trip there around the end of the year to firm up details. I have access to a site on the top of the 11,300' volcano there, and I had though about a beacon there. I need to talk to Chip (Angle) about this some more. If I can figure out how to remotely control some rigs, I'd like to look at installing an HF/6m/2m system there also after we settle. The home will be around 3500-4000' up, but I will mainly do EME from there, as terrestrial means will be blocked from NE to NW. I have also thought about getting the capability to run up/down to sites at various for tropo tests. I'd like to think there is a path to KH6, if not W6 from there, under proper conditions and equipment; but that will be a couple years in the future.

How About Honest Signal Reporting?

by Louis Anciaux, HL9UH

Something that has bothered me a bit since spending more time on HF than previously is the "normal" 599 reports that virtually all QSOs are made; especially true with DX stations and during contests. Obviously a need for swift exchanges with the DX station seems to obviate any meaningful information exchange, other than a single call & 599 & X as being the QSO. In the vast majority of those QSOs with JAs, as you'll note in the log sheets, they also send 599 or 5-9 if SSB.

The signal levels are not strong, save a very few via Es. As most are via a backscatter mode, signals are typically S1-3, which is what I send them. However, they usually send the 599, which either tells me they are running peanut

compared to my 100 W; or, that they copied me, so the report must be 599!? Actually, their report is meaningless to any sort of decent idea of what the path is doing at any particular time. A lot of the cards do indicate 10 W rigs; but, even that doesn't account for the 6-8 X units difference!

I'm a little ambivalent about DX contacts and the 599 when the party on the other end requests information be repeated 2-3 times. Is it more appropriate to make the QSO for a DXCC list and not to pay attention to our purported "reason to be" of passing information via radio? But, making a quick QSO so one can add to a DXCC list seems to make a little sense when taken in that context only.

However, I'm more than just a bit insistent that our RST system "sucks"! For contests, passing information of a 599 + a digit that changes one at a time per QSO that one can listen to when others are on, make little sense in the scheme of why we are radio operators. I think we ought to have something "unique" to each station information sent as the exchange. That is then a REAL tests of one's communication ability! For example, another six digit plus a 4 digit sequential number; i.e., 621234 would be '62 as first licensed and QSO #1234. This, or something similar would be a much more viable test of one's communication ability. That is a stated reason for these contests.

But, more important to all of us who profess to chase VHF DX as a means of studying propagation, is the necessity of meaningful reports. When you hear a station just at the noise floor and he responds with a 599 to your 100 W signal--what does that really say about propagation? Not one damn thing worth noting! If the mode is via the ionosphere and covers a wide area, all those signals with 599 reports likewise say NIL. If they each come with real numbers, you can actually see the extent of the landing zone and how fast it drops off at the edges. Movement of Es clouds is also relatively easy to detect with meaningful data.

Obviously, you of all people, realize more than the rest of us, just how important good propagation data is. My suggestion is that you use the bulletin pages in an effort to promote meaningful reports for all VHF/UHF operations in order to build a real picture of the world--not one distorted by everyone being 599. I personally don't give a damn if my report is 219 or 529 or 559. If I copied the info, the QSO was made and I know a little about the path (especially once I know what he was running). The 599 report tells me the other operator is probably an uneducated appliance operator! God, we do need more of them, don't we?

Enough. Just a couple of soapbox comments.

ARRL agrees: The World is not a perfect sphere!

I don't know if our article had anything to do with it, but The World Above 50 MHz (June 1993) has decided to use a more accurate model of the earth for determining path lengths for VHF records. During the coming year, Al Ward, WB5LUA, will be reviewing all existing claimed records.

Michael Owen, W9IP, wrote the lead to the June 93 column, announcing the availability of BD, a program written in Pascal, and compiled for IBM PC-compatibles, that determines bearing and distances.

I sent a formatted disk and SAS disk mailer to Emil Pocock, Box 100, Lebanon, CT 06249; and have received the program back. OK! you ask, how did we do?

The program didn't work on my Sanyo MBC-550, by the way, even in IBM video mode. That computer is the one I use to compose the bulletin. The program did work on a '386, however, and the answers, for two paths:

My QTH 37.4633N 122.3450W
AH3C, Johnston Is. 16.750N 169.517W
OG89KG center (VK6PA) 20.729S 116.875E

Ranges in km

Path	BD	Oblate Spheroid	Sphere
K6FV-AH3C	5142.499	5142.5	5137.7
K6FV-VK6PA	14070.701	14070.8	14066.8

Bearing in degrees

Path	BD	Oblate Spheroid	Sphere
K6FV-AH3C	256.73	256.66	256.61
K6FV-VK6PA	270.93	270.72	270.73
AH3C-K6FV	53.86	53.91	53.74
VK6PA-K6FV	58.13	58.21	58.06

Guess we'll have to ask the Mad Hacker to put in the higher order terms of the geopotential. Just kidding-folks!

Optimized Six-Meter Yagi

by Brian Beezley, K6STI

Here's a design for a 5-element beam on a 23-foot boom with an unusual combination of performance characteristics. This Yagi comes within 0.2 dB of the maximum gain possible on the boom length while keeping all backlobes 20 dB down. This performance combination is very rare.

The trick was to optimize the design over a narrow frequency range, 50.000 to 50.250 MHz. Many 6-meter beams, both homebrew and commercial, are designed to work to 51 or even 52 MHz. These designs invariably sacrifice forward gain and pattern quality for wide SWR bandwidth.

When optimizing a design over a narrow bandwidth, fewer elements are needed. As long as you have a certain minimum number, Yagi forward gain is determined by boom length, not element count. Elements added to the interior of this design won't increase its gain. (They may increase the bandwidth over which the pattern and SWR remain good, but this design adequately covers the low end of 6 meters.)

The free-space forward gain of this Yagi varies from 10.2 to 10.4 dBd over 50.000 to 50.250 MHz. These figures include conductivity losses of 0.08 dB for 6061-T6 aluminum elements. When matched at 50.135 MHz, SWR is less than 1.4 across the frequency range. The worst-case backlobe is 20 dB down at 50.000, -21 dB at 50.100, and rises to -16 dB at 50.250 MHz. This design was simultaneously optimized for maximum forward gain, minimum worst-case backlobes, and adequate impedance. Conventional F/B was not optimized. This parameter takes the rear pattern into account at just a single point.

The tuning of Yagi elements depends not only on their length but also on diameter, diameter tapering, and mounting method. These factors affect element self-impedance and thus alter antenna response. Thinner elements, tapered elements, conductive mounting brackets, and through-the-boom mounting shorten effective element length. Design

dimensions are given for insulated, untapered, 0.375"-diameter elements, for insulated, untapered, 0.5"-diameter elements, and for elements with Cushcraft A50-6S tapering and mounting. If you use different elements or mounting methods, you'll need to adjust element lengths for optimum performance.

This design has a special property which makes it easy to adjust element tuning experimentally. The azimuth pattern has three backlobes which are equal in amplitude only at 50.100 MHz. Since rear-lobe amplitude changes rapidly with frequency, you can easily verify that your antenna is correctly tuned. If the rear lobe is larger than the other two backlobes, the effective length of your elements is too long. If smaller, your elements are too short. You can use this simple test to obtain correct electrical behavior for any physical element mounted by any method. When adjusting parasitic-element lengths, make equal changes to all parasitics.

The input impedance of this design is about 12.5 ohms. You can use any matching method as long as you observe the fundamental rule of Yagi matching: Never alter parasitic-element lengths or spacings of an optimized design to get a good match. Driven-element length has virtually no effect on gain or pattern, so you're free to adjust this dimension when matching. Don't alter element spacing. Change parasitic-element lengths only to move the equal-backlobe frequency to 50.100 MHz.

When I built this antenna in 1989, I gamma-matched it. However, I wouldn't do this with the knowledge I have today. A gamma match can induce current on the shield of a coaxial feedline. It can also induce current in the boom unless the driven element is insulated. These stray currents can reduce forward gain and degrade the pattern. You may be lucky as I was and get away with gamma-matching, but why take a chance? Use a hairpin, T match, or folded dipole and a good balun.

The 12.5-ohm input impedance transforms to a feed impedance of 50 ohms for an equal-diameter folded dipole. You can feed the folded dipole directly with 50-ohm coax if you use a current-type balun. You can make one by slipping ferrite beads over the coax or you can simply coil the coax into a few turns near the feedpoint.

This design was developed in 1989 but was not published for some time. A carefully constructed, untapered, insulated-element version of this design came out 220 KHz low. (I had to DF cordless phones below the 6-meter band to find the equal-backlobe spot!) I thought that perhaps some obscure environmental factor was responsible for the discrepancy (like the conductivity or dielectric constant of my composition roof). In typical ham fashion, I simply cut a quarter inch off each element tip and used the beam successfully. But the 220-kHz anomaly continued to bother me. It wasn't until I began to use the sophisticated Numerical Electromagnetics Code that I finally understood what was going on. NEC predicted that the antenna would perform as originally measured. The MININEC-calibrated algorithm I used to optimize this design had a built-in frequency offset! I immediately recalibrated all of my antenna-design programs to NEC. I subsequently found references to the MININEC frequency offset in the professional literature.

If you optimize this Yagi for maximum forward gain without regard to pattern, impedance, bandwidth, construction tolerances, or reason, you can squeeze 0.2 dB more out of the design. However, the backlobe degrades to just 11 dB down and input impedance nosedives below 5 ohms. You say that you can match anything? That you never leave 50.110? That you don't experience rear-signal QRM on 6 meters, and that you want all the gain you can possibly get? What about those damn power leaks that always seem to start up from every direction whenever the band opens? What about the 3C0 DXpedition which shows up on 50.300 and gets chased off the island before you're done retweaking your match up on the tower? If you're greedy about Yagi forward gain, you'll live to regret it.

You can stack two of these Yagis for more gain. An H-plane stacking distance of 27 feet provides 3.1 dB additional gain in free space. (Other stacking distances shift the equal-backlobe frequency away from 50.100 MHz and require element readjustment.) However, unless the array is very high, you won't come close to free-space stacking gain in practice. The elevation patterns of Yagis at different heights don't combine favorably. For example, adding a second Yagi 27 feet below one at 50 feet improves gain less than 1.2 dB at elevation angles below 5°. E-plane stacking is an attractive alternative. If you space the booms 29 feet horizontally, you'll get 3.0 dB gain over a single Yagi regardless of height. The 3-dB beamwidth will be ±9°, with deep nulls at ±20° and sidelobes 9.4 dB down at ±31°. Before you go to the trouble of E-plane stacking, think carefully about the operational inconvenience of such a narrow main lobe. The crossboom must be nonconducting near the Yagis. If you'll settle for an improvement of 2.6 dB, the 8-element Yagi listed below is much more manageable than a side-by-side pair of 5-element designs.

To give you an idea of how this Yagi compares with other designs, here are some NEC results at 50.110 MHz:

	A50-5S	Four	NBS-5	A50-6S	Five	NBS-6
Boomlength	11'8"	13'8"	15'9"	19'7"	22'7"	23'7"
Number of Elements	5	4	5	6	5	6
Forward Gain, dBd	7.7	8.8	9.1	8.8	10.3	10.2
Rel. Power, watts	100	130	136	130	181	179
Gain FOM, db	-1.0	-0.2	-0.3	-1.0	+0.1	-0.1
Worst Backlobe, dB	-19	-20	-13	-26	-20	-14

	Six	617-6B	6M2WL	Seven	Eight	6M2.5WL
Boomlength	31'0"	33'2"	39'4"	39'8"	48'7"	50'4"
Number of Elements	6	6	9	7	8	11
Forward Gain, dBd	11.4	10.1	11.6	12.2	12.9	12.3
Rel. Power, watts	233	172	248	279	327	289
Gain FOM, db	+0.3	-1.2	-0.1	+0.3	+0.4	-0.3
Worst Backlobe, dB	-19	-21	-22	-20	-21	-19

A50-5S, A50-6S, and 617-6B are wideband Cushcraft designs. 6M2WL and 6M2.5WL are M2 Enterprises designs. NBS-5 and NBS-6 are National Bureau of Standards designs empirically optimized for maximum forward gain. Five is the subject of this article, while Four, Six, Seven, and Eight are other computer-optimized, narrowband designs. Gain figure-of-merit is antenna gain minus maximum practical gain (maximum gain for the boom length with reasonable input impedance and bandwidth, a definition which is vague but which can be evaluated mathematically as a function of boom length).

As N6ND says, for a really good signal you need dBs in the air and dBs on the desk. This simple Yagi design will take care of airborne dBs. Desktop dBs are a matter between you, your licensing authority, and your spirit of adventure.

Element Positions and Half-Lengths For Optimized 5-Element Yagi

Position	El #1	El #2	El #3
0.00"	57.54"	57.42"	58.43"
44.06	54.85	54.59	55.9
107.89	53.48	53.16	53.88
194.86	52.59	52.23	52.89
270.62	52.59	52.24	52.90

El #1: 0.375" diameter, nonconductive mounting bracket
El #2: 0.5" diameter, nonconductive mounting bracket
El #3: Cushcraft A50-6S element/mount (24" half-length of 0.75"-diam., 0.625"-diam. tips, U-bolt mount)

Half-lengths are lengths measured from the center of the boom to element tip.

A Request from Drago, S59UN

Hello six mtr fans.

After working George, 5R8DG on 6 mtrs, I had a conversation with him on 15 mtrs. He explained the problems with his equipment, especially with his 6m antenna, which is a simple dipole, and his low output power of 8 W. His main problem is getting proper aluminum tubing down there in the Malagasy Republic.

So I decided to buy an F9FT 5 el yagi, the same as I am using and have found to be very sufficient. The antenna costs 1,090 ATS (some 150DM) in OE land. I am going to post it to George tomorrow.

I have already received donations from OE6OWG and OE6LOG, each 50 ATS! At the moment I do not know how expensive the shipping will be, but I am going to ask you 6 mtr fans for a small donation. It can be in the form of IRC coupons too.

If the amount received exceeds the antenna cost + shipping, I propose to organize a fund for similar cases. Perhaps we can help 7X2KT, UW0CT, or some other guys who are willing to activate some rare areas, but they have no opportunity or possibility to do that because ... (you know why).

I now have 5R8 on six, but I would like George to stay on six as well as us better-equipped six meter enthusiasts or fanatics will, and my great wish is to bring more rare ones on the MAGIC BAND.

Those shall give us more joy and make the MAGIC BAND more popular. Thanks in the name of George, myself, and all of those who still are looking for him.

73 de Drago S59UN, ex YU3ZV (June 28, 1993)

Ed--there are some of us here in the U.S. who could experience difficulties by having financial dealings with citizens of the former Yugoslavia, Malagasy Republic, Iran, Iraq, Libya, or even most of the constituent republics of the former USSR. It would be nice if we could find a "politically-acceptable" intermediary, such as the ARRL, RSGB, UKSMG, or WCDXF, that would accept directed donations. On the other hand, IRCs are probably untraceable.

6m DX at HL9UH during 1992 November

Nov 1 0217-0255, VK4KK, VK4HG, VK4ZNC, VK4FD, VK4JRO, VK4AFL, VK4DDC, VK4ACE, VK2YDC, VK4TN, VK4KJL, VK4PU, VK4ABP, VK4CAB, VK4ALM, VK8ZLX, VK4YZ, VK4KAA, VK4WTN; 0259, FK8DH; 0305, JA6TEW.

Nov 11 0645-0702, VK4FAR, VK4UTT, VK4KJC.

Nov 16 0717, VK6YU.

Nov 22 0347, ZL4AAA; 0400-0615, 45.24, 45.25, 45.26, 46.25.

Nov 27 0600 hrd KH2/KB5VRF/AG bcn on 50.120. Worked him 0648. Hide, QSL via JR4PMX.

Nov 30 0845 DX1 beacon in S9+ and telephone extenders on .017 (old RP one near Quezon City part of Manila).

Perseids 1993

The Perseids put on a pretty impressive show August 11 of 1992, as 2 mtr ping jockeys will attest. Will we have a repeat in 1993?

August 1993's ***Sky & Telescope*** has a couple articles about Meteoroid Streams and the Perseids in particular. They published the following table re: the Perseids and its parent comet Swift-Tuttle (which has a 130 year period).

The Perseids and Comet Swift-Tuttle

Year	Earth crosses comet's orbit plane (UT)	Peak of Perseid Shower	Time difference	Comet's distance
1991	Aug. 12, 13:30	Aug. 12, 16:20	+2h 50m	-506.5 days
1992	Aug. 11, 19:30	Aug. 11, 19:30	0h 00m	-141.4 days
1993	Aug. 12, 01:15	Aug. 11, 22:25?	-2h 50m?	+223.7 days

If the meteoroids are moving in *exactly* the same orbit as P/Swift-Tuttle, then we would expect to encounter the Perseid maximum August 12 at 0115. However, the meteor swarm has apparently been shifting position slightly with respect to the orbital plane of the comet. The intense shower of 1992 occured at the same time as the Earth crossed the plane. But the 1991 peak came almost 3 hours *later*. Linear extrapolation would suggest the 1993 shower would come nearly 3 hours earlier, resulting in a peak centered around August 11 at 2220.

While optical viewers in the Western Hemisphere would thus be shut out, radio amateurs would not, because the shower's radiant at the Perseus-Cassiopeia border does not set for latitudes greater than about 28° N.

The article indicates an optical rate of 450 per hour for the 1991 shower. In 1992, despite a full moon, observers saw an even more impressive shower, and radio amateurs operating 2 mtrs saw almost continuous strong echoes. Echoes are longer on 6 mtrs. Since the ablated meteor "stuff" (mostly Ca++ and Fe++) may result in abnormal levels of ionization in the E-region over the northern hemisphere, 6 mtr devotees should be alert to the possibility of really long distance propagation. How prevalent this artificial E-layer will be will also likely be dependent on whether the prevailing winds (and geomagnetic field) tend to concentrate or diffuse the meteor ionization. We'd appreciate receiving your reports of any long-haul DX reception or 6m QSOs during this event. By long-haul, we mean beyond normal meteor range, ~2400 km.

Two Meter Sporadic-E during 1993

I guess I could fake this article by predicting the big Sporadic-E openings that **will** be observed by Europeans on 144 MHz May 12, June 8, 1993; etc., but I'd better come clean. This make-up issue is being written in late July 1993; the July issue having been put to bed a couple nights ago. I've just received the June/July 1993 issue of ***The VHF-UHF DXer***, and I've become aware that the excitement of Sporadic-E openings over the European continent has not been confined to six meter enthusiasts.

True, our masthead proclaims **50 MHz**, but I'm inclined to bend that a bit. After all, we've given space to propagation indicators **below** 50 MHz, why not 4 meters, TV carriers, why not even 144 MHz, if the propagation is by some ionospheric mode we'd observe at 50 MHz, like Trans-Equatorial Propagation (TEP), Sporadic-E (Es), or Aurora (Au)?

If you're still with me, and not sharpening your poisoned quills, you should know that the following information is from **2m Report** in May and June/July 93 ***The VHF-UHF DXer***, a monthly publication available for £10 in the U.K., £12/US$20/DM30 in Europe, and £14/US$24 Worldwide (air) from Dave Hardy, G8ROU, Thorntree House, Wensley, Matlock, Derbyshire DE4 2LL, United Kingdom.

On May 12 at 1641, G0KON in IO80 worked SV1OH in KM18, more than 2400 km distant, on 2m. On the same date, G7JXR in JO02 worked I7UGO in JN80, IK7UXY and I7IWX in JN90, SV3KH in KM07 on 2m. Also on May 12, G3KEQ in JO01 worked I7UGO, SV3KH, IW7CGF (JN81), IK7UXY, IK7CMY and I7IWN (all JN90).

On June 6, VS6YHT managed to work an HL on 2m FM by Es. This after hearing much packet on 144.7. Aurora was reported by G4SWX, who worked SM2CEW and then UZ2FWA with 10 degrees of elevation at each end. SM2CEW was also reported to have worked a good collection of PA/DL stations.

Sporadic-E was in again on June 8, with G4YRY working into OK2 ~0925, and French stations working into SP. A second event started at 1040 and ended at 1120 for G4YRY in which he worked into SV and 4N (KN01). During this period, PA stations were working into I7/8. G3BW is reported to have heard some Italians and at around 0820, he and G4MTR worked a couple of 9A (Croatia) stations. DL1GNM reported a 2m opening between 1035 and 1052 to SV2 and 4N.

June 10 was a big day for 2m Sporadic-E and ended up with an Aurora. DB8KJ reported an opening to SV1/2 around 0900, and there was a solitary report of propagation between ON and EA7 at 1125. At 1520 G4ASR worked IK0BZY and YO2IS was worked from PA/ON. At 1600, the band opened all over Europe. G4YRY started by working into YO2/5 and HG. At the same time GM0GMD was working into EA, F, and EA6; ON and PA were working into LZ/UY; the Ruhr area of DL into LZ, and S5 into EI. Most of these QSOs imply a common reflection area over Southern Germany, except GM0CMD's QSOs which need an area over North-West France.

GM0CLN/P made his first QSO of 120 with F6EPE while still mobile on the way to his site. As the event progressed GM0CLN/P worked I2,3,4,5,6,8 through to the south of France, and then into EA2/3/5. About 1735, there was about a 10 minute pause until the event returned in I4, S5, SE France, and then shortening into DL, HB9, YU, 4N and OE. Presumably upon the return of signals, the GM stations have switched reflecting areas from the French one to the one over Germany which had edged slightly further west. At about 1838, the opening swung into 9A, YU, LZ & S5 for GM0CLN/P, then up to OM3, HG and YO, and then wrapped up by covering a wide area from OM3 through to YO up until 1910. GM4CXM is reported to haave worked 9H1PA at about 1745, a distance of over 2600 km. GM0GMD reported a second phase to southern France between 2034 and 2140.

GM0HUO's 2m opening started at 1541 into EA5/3 and Southern France, moving through EA6 at about 1630 and then on into I5/8 at 1640, before coming back to Southern France and EA3 at 1650. It also went quiet between 1736 and 1804 when the more easterly area took over with propagation to I4, 9A, OE, and YU. He also caught the second phase between 2045 and 2138 in Southern France and EA3.

G4ASR worked 47 stations starting in I, and working through S5, UB5BDC, RB5GU (another long one--2500 km), YU, HG, and OK1 until he experienced a pause at around 1745. It is interesting that apparently both reflecting areas dropped out at about the same time, although they appear to have been separated by 800 km or so. For G4ASR, the event restarted at 1836-1915, and ran into SP9, OK2, OM3, and then through SP7, 6, 8, 9, 3 via a quick dip into HG & OE, and then finishing up in OK2 and SP9.

G4SWX has a much scratchier opening, starting at 1614 with YU, HG, and LZ, moving into I4-0 (most areas) until it went quiet at 1650. He was then frustrated until 1835 when he had a short burst and worked several I5 stations.

G4YRY worked very similar stuff to G4ASR, but he did catch T94KU (JN94) in Bosnia. To round off the evening, he worked (on Au) GM0HBK, GM4AFF, and GM0HUO. At one point GM4AFF went almost T9 on a heading of 330 degrees, and it's interesting to note that French stations were working GM by Sporadic-E just a little earlier--was this auroral E or was it just zero doppler aurora?

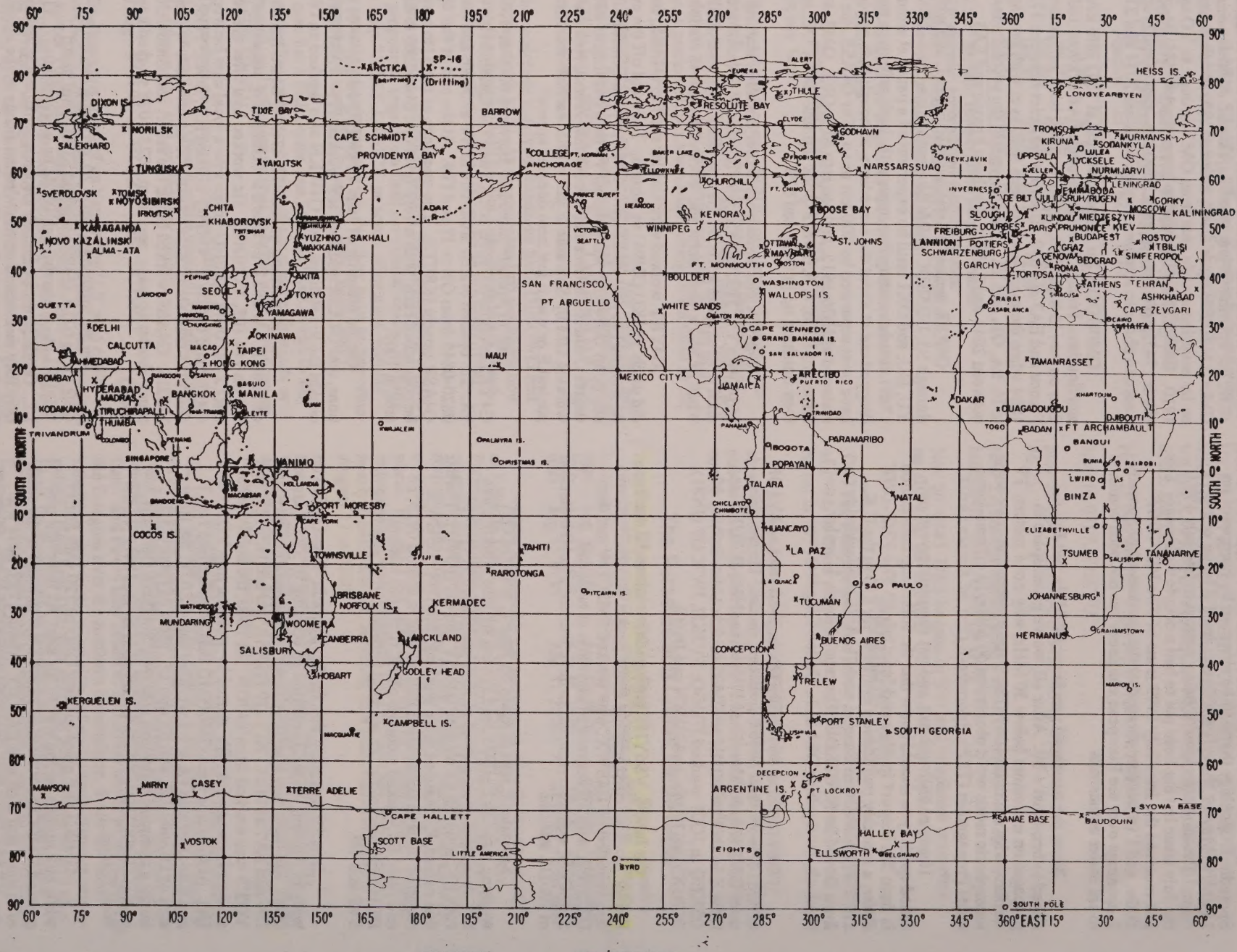
June 11 brought more Es. Between 0603 & 0707, G4YRY worked YU, 9A, S5, T9 and I3. G4ASR also worked 9A. 2m opened briefly from ON to SV at 0800, and then from 0820-0845 from ON to I7 and IT9. At the end of this opening, G4ASR caught IK8ETN. The openings of the 11th seemed to be concluded early with a very brief one from LZ3 to the JO30 area at 1005.

On the morning of June 12 G4PIQ caught 4 9H stations, and G4ASR and G4YRY worked IT9. PA3FXW also caught the 9H stations, and G4WKN also worked an IW9.

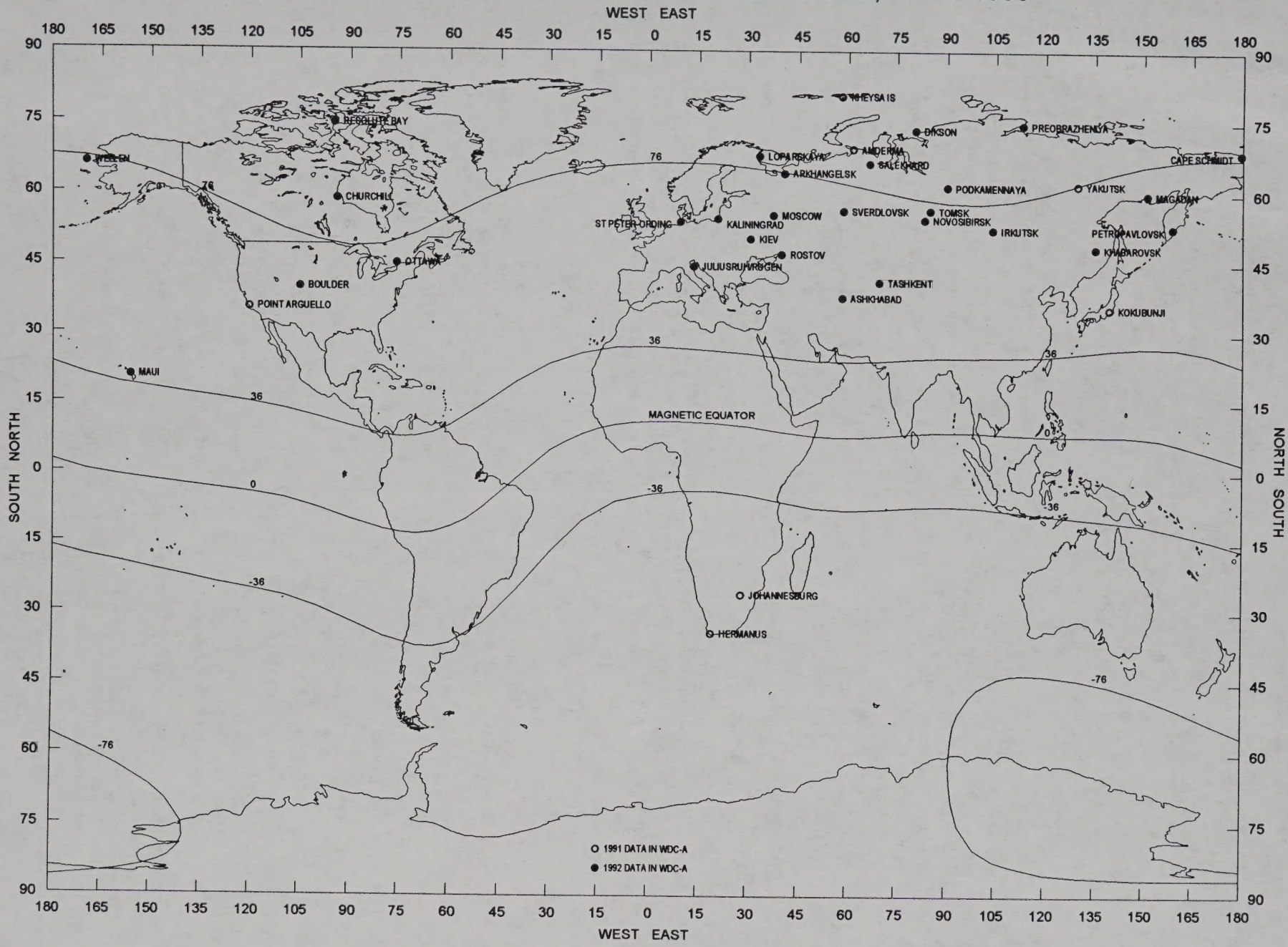
On the morning of June 13, G4PIQ heard Italian stuff on band II. At 0932, he heard a drifting CW station calling CQ on 144.105, YO5DGE. He worked him after the 3rd QRZ?. At 0948 HA0HO broke into a local chat between G4PIQ and G4SWX. G4PIQ worked HA, OM3, YO5, OE1, and YU7 until about 1036. G4SWX additionally woked YO2IS. G4ASR worked much the same, and GM0HUO had a much shorter opening, and from 1023-1028 worked/heard 9A and I3.

On the morning of June 20, on being alerted by G4BAH at 0715, G4PIQ worked SV8JE and heard SV1BRL/A. Then through 0806, he worked into I7, YU, and LZ. G4SWX worked much the same stuff, but it was evident they they were much on the Western fringe of the opening--frequently they were in a pileup for someone along with stations in JN49, and it was a bit of a struggle!

IONOSPHERE VERTICAL SOUNDINGS STATIONS, OCTOBER 1973



IONOSPHERE VERTICAL SOUNDING STATIONS, APRIL 1993



DL8EBW the same stuff, but a few more of the I7 stations. Little else was worked further inland, other than G0CUZ working one of the I7s about ten minutes closed to DL.

The Decline & Fall of Ionospheric Sounding

Remember those halcyon days of the International Geophysical Year (IGY)? Data being collected from all over the world just for the sake of science? One of the results of the IGY was the establishment of three World Data Centers to collect data from the numerous and wide-spread IGY observational programs and to make such data readily accessible to interested scientists and scholars for an indefinite period of time. WDC-A was established in the U.S.A. in Boulder, CO, WDC-B, in the U.S.S.R. in Moscow, and WDC-C, in Western Europe, Australia and Japan in Tokyo.

Those were the years (1957-1958) for vertical incidence ionospheric sounding. The map on page 6 shows most of the stations active between 1957 and 1973.

By way of contrast, the map on page 7 shows most of the presently operating vertical sounding stations, or at least those who submit their data to the WDC. The contours on page 7 are of magnetic dip. 76 degrees dip marks approx the equatorward boundary of the auroral zone. 36 degrees dip marks approx the areas where maximum F2-layer critical frequencies occur.

For any of you, like me, who would like to determine the state of the ionosphere during some great or not-so-great VHF opening, or develop a new world-wide model with the latest computer methods, the present state of affairs is an unmitigated disaster. How did Boulder come to this state of affairs? A colleague of mine wrote a few years ago:

"The logical US center for sounders should be Boulder, but they perceive themselves to be far out of action because of low budgets. In the early 1970s, Bill Wright and many others there developed a highly sophisticated vertical sounder, the "dynasonde". Bill's 16mm movies of such data remain to this day the best I've ever seen.

In about 1973, budget problems lead Boulder to consider zeroing the budget for maintaining the C-series sounders and yanking support from the dynasonde. Hoping to head this move off at the pass, the Boulder staff convinced URSI to create an "Ad Hoc Committee on the Utilization of Ionosonde Data". This committee lasted from January to August 1974. As it turned out, they found that almost no Americans cited use of Boulder ionosonde data in any papers, but foreign authors used it much more, particularly in JATP. Later, Boulder continued maintaining the C-series, but not the dynasonde, which was a great disappointment to Bill Wright, who moved on the greener fields in Germany where he remains to this day.

The dynasonde sought to correct several basic flaws of the ordinary vertical sounder, flaws that particularly cripple it in auroral or equatorial regions. The two main flaws are an inability to identify echoes from tilted media and an inability to identify which echoes are Ordinary and eXtraordinary modes. Both of these things have to be done before it makes much sense to invert the ionograms (Ed-create a profile of electron density vs height).

In the early days, the **digisonde** was a dynasonde competitor being developed of U. Lowell under USAF sponsorship, mainly for use in dreadful places like Thule where an ordinary vertical sounding is trash. To deal with the complex ionosphere, they measured both the elevation and azimuth angle of every echo independently and they also measured its Doppler shift. To display the resulting multi-dimensional data, they developed a character-based display. By 1983, the development was considered done, and an RFP (Ed-Request For Proposal) was issued to build about 20 of them for the USAF to set up around the world--to service Air Weather Service, not the civilian market or Boulder.

World-wide the present system is, to say the least, diverse. The dynasonde still exists, but I have lost track of it (them). The digisondes are running, but they produce a lot of RFI (Ed-Radio Frequency Interference), cost a lot, and for use as a tool for acquiring an ionospheric model in the temperate zone, they are a huge overkill. For the temperate regions, Australians and Europeans produce conventional simple echo sounders such as the C-series, but with modern electronics."